

**What is claimed is:**

1       1. A receiving method for a dual-mode receiver,  
2 the method characterized in that:

3           when a received communication signal is a wideband  
4           signal, the dual-mode receiver is configured as  
5           a direct-conversion receiver; and

6           when a received communication signal is a narrowband  
7           signal, the dual-mode receiver is configured as  
8           a low-IF receiver.

1       2. The method of claim 1, wherein receipt of a  
2 communication signal by a direct-conversion mode further  
3 comprises:

4           receiving an input signal with a carrier;  
5           amplifying the input signal;  
6           converting the amplified signal down to baseband  
7           signals, wherein the baseband signals comprise  
8           an I-channel signal and a Q-channel signal;  
9           canceling DC offsets of the I-channel signal and the  
10           Q-channel signal; and  
11           filtering and amplifying the signals without DC  
12           offsets to generate a pair of signals output.

1       3. The method of claim 1, wherein receipt of a  
2 communication signal by a low-IF mode organized further  
3 comprises:

4           receiving an input signal with a carrier;  
5           amplifying the input signal;  
6           converting the amplified signal down to intermediate  
7           frequency signals, wherein the intermediate

frequency signals comprise an I-channel signal and a Q-channel signal; canceling DC offsets and image of the I-channel signal and the Q-channel signal; filtering and amplifying the signals without DC offsets and image to generate a pair of signals; and converting the pair of signals down to baseband signals output, wherein the baseband signals comprise a second I-channel signal and a second Q-channel signal.

1       4. A dual-mode receiver, comprising:  
2        an antenna for receiving an input signal with a  
3               carrier from a transmitting channel;  
4        a low noise amplifier coupled to the antenna, for  
5               amplifying the input signal;  
6        a quadrature mixer coupled to the low noise  
7               amplifier, for receiving an amplified signal  
8               and two local oscillator signals respectively  
9               with a first phase and a second phase, wherein  
10          when the dual-mode receiver operates in a  
11               direct-conversion mode, the quadrature mixer  
12          converts the amplified signal down to a pair of  
13               first baseband signals and when the dual-mode  
14          receiver operates in a low-IF mode, the  
15               quadrature mixer converts the amplified signal  
16          down to a pair of second intermediate frequency  
17               signals with the carrier whose frequency is a  
18               first frequency;

19       a pair of dual-mode filters coupled to the mixer,  
20            wherein when the dual-mode receiver operates in  
21            the direct-conversion mode, the dual-modes  
22            filters are a pair of low pass filters and when  
23            the dual-mode receiver operates in the low-IF  
24            mode, the dual-modes filters are a pair of  
25            poly-phase filters;

26        a pair of programmable gain amplifiers respectively  
27            coupled to the dual-mode filters, wherein when  
28            the dual-mode receiver operates in the direct-  
29            conversion mode, the programmable gain  
30            amplifiers receive first baseband signals to  
31            generate a pair of first signals output and  
32            when the dual-mode receiver operates in the  
33            low-IF mode, the programmable gain amplifiers  
34            receive the second intermediate frequency  
35            signal signals to generate a pair of second  
36            signals output;

37        a secondary downconverter, wherein when the dual-  
38            mode receiver operates in the low-IF mode, the  
39            secondary downconverter receives the second  
40            signals and a second local oscillator signal,  
41            and converts the second signals to a pair of  
42            third baseband signals output; and

43        a pair of switching elements for connecting the  
44            programmable gain amplifiers to the secondary  
45            downconverter when the dual-mode receiver  
46            operates in the low-IF mode.

1       5. The dual-mode receiver of claim 4, wherein the  
2 dual-mode receiver further comprises:

3           a local oscillator for generating a local oscillator  
4           signal with the first phase, a local oscillator  
5           signal with the second phase and a second local  
6           oscillator signal;

7           a digital signal processor, wherein when the dual-  
8           mode receiver operates in the direct-conversion  
9           mode, the digital signal processor receives the  
10          first signals to generate data information  
11          output and when the dual-mode receiver operates  
12          in the low-IF mode, the digital signal  
13          processor receives the third signals to  
14          generate data information output; and

15          a pair of switching elements for connecting the  
16          programmable gain amplifiers to the digital  
17          signal processor when the dual-mode receiver  
18          operates in the direct-conversion mode.

1       6. The dual-mode receiver of claim 4, wherein the  
2 first phase and the second phase are respectively 90° and  
3 0°.

1       7. The dual-mode receiver of claim 4, wherein the  
2 secondary downconverter is implemented with an analog  
3 circuit.

1       8. The dual-mode receiver of claim 7, further  
2 comprising an analog-to-digital converter coupled after  
3 the secondary downconverter.

1        9. The dual-mode receiver of claim 4, wherein the  
2 secondary downconverter is implemented with a digital  
3 circuit.

1        10. The dual-mode receiver of claim 9, further  
2 comprising an analog-to-digital converter coupled between  
3 the secondary downconverter and the programmable gain  
4 amplifiers.

1        11. A dual-mode receiver, comprising:  
2            an antenna for receiving an input signal with a  
3            carrier from a transmitting channel;  
4            a low noise amplifier coupled to the antenna, for  
5            amplifying the input signal;  
6            a quadrature mixer coupled to the low noise  
7            amplifier, for receiving an amplified signal  
8            and two local oscillator signals respectively  
9            with a first phase and a second phase, wherein  
10          when the dual-mode receiver operates in a  
11          direct-conversion mode, the quadrature mixer  
12          converts the amplified signal down to a pair of  
13          first baseband signals and when the dual-mode  
14          receiver operates in a low-IF mode, the  
15          quadrature mixer converts the amplified signal  
16          down to a pair of second intermediate frequency  
17          signals with the carrier whose frequency is a  
18          first frequency;  
19            a pair of low pass filters coupled to the mixer,  
20            wherein when the dual-mode receiver operates in  
21          the direct-conversion mode, the low pass

22           filters receive the first baseband signals and  
23           when the dual-mode receiver operates in the  
24           low-IF mode, the low pass filters receive the  
25           second intermediate frequency signals;  
26           a pair of programmable gain amplifiers respectively  
27           coupled to the dual-mode filters, wherein when  
28           the dual-mode receiver operates in the direct-  
29           conversion mode, the programmable gain  
30           amplifiers receive first baseband signals to  
31           generate a pair of first signals output and  
32           when the dual-mode receiver operates in the  
33           low-IF mode, the programmable gain amplifiers  
34           receive the second intermediate frequency  
35           signal signals to generate a pair of second  
36           signals output;  
37           a quadrature secondary downconverter, wherein when  
38           the dual-mode receiver operates in the low-IF  
39           mode, the secondary downconverter receives the  
40           second signals and two second local oscillator  
41           signals respectively in the first phase and the  
42           second phase, and converts the second signals  
43           to a pair of third baseband signals output; and  
44           a pair of switching elements for connecting the  
45           programmable gain amplifiers to the quadrature  
46           secondary downconverter when the dual-mode  
47           receiver operates in the low-IF mode.

1           12. The dual-mode receiver of claim 11, wherein the  
2           dual-mode receiver further comprises:

3       a local oscillator for generating the local  
4        oscillator signal with the first phase, the  
5        local oscillator signal with the second phase,  
6        the second local oscillator signal with the  
7        first phase and the second local oscillator  
8        signal with the second phase;  
9       a digital signal processor, wherein when the dual-  
10       mode receiver operates in the direct-conversion  
11       mode, the digital signal processor receives the  
12       first signals to generate data information  
13       output and when the dual-mode receiver operates  
14       in the low-IF mode, the digital signal  
15       processor receives the third signals to  
16       generate data information output; and  
17       a pair of switching elements for connecting the  
18       programmable gain amplifiers to the digital  
19       signal processor when the dual-mode receiver  
20       operates in the direct-conversion mode.

1       13. The dual-mode receiver of claim 11, wherein the  
2       first phase and the second phase are respectively  $90^\circ$  and  
3        $0^\circ$ .

1       14. The dual-mode receiver of claim 11, wherein the  
2       quadrature secondary downconverter is implemented with an  
3       analog circuit.

1       15. The dual-mode receiver of claim 14, further  
2       comprising an analog-to-digital converter coupled after  
3       the quadrature secondary downconverter.

1        16. The dual-mode receiver of claim 11, wherein the  
2 quadrature secondary downconverter is implemented with a  
3 digital circuit.

1        17. The dual-mode receiver of claim 16, further  
2 comprising an analog-to-digital converter coupled between  
3 the quadrature secondary downconverter and the  
4 programmable gain amplifiers.